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Characterization Analysis Report
Weather Deck Runoff

Section 4.0 – Cleaning Activities and General Housekeeping

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4.0 CLEANING ACTIVITIES AND GENERAL HOUSEKEEPING

Cleaning and general housekeeping include aircraft washdowns, electronic intelligence/navigational systems, equipment and vehicle washdowns, exterior topside surface washdowns, and firemain systems. The following paragraphs provide more details on each of these processes.

Aircraft washdowns include cleaning the exterior surfaces and engines of fixed and rotary wing aircraft. The washdown effluent may contain traces of fuel, dirt, salt, hydraulic fluid, lubricating oil, soot (from ship's main propulsion unit), greases, and aircraft cleaning compound. Depending on the vessel class, this effluent is either vacuumed off the deck and discharged overboard or discharged directly overboard. For Navy vessels, aircraft washdowns occur outside of 12 nm and are not regulated by UNDS. However, some of these compounds may become trapped in rough deck surfaces and residual amounts may contribute to deck runoff within 12 nm. For USCG vessels, the majority of aircraft washdowns occur outside 12 nm; the effluent discharges directly overboard.

The survey team determined that the maintenance of electronic intelligence/navigational systems evaluated on AOE 6, DDG 51, MCM 1, WLM 175, and WPB 110 Class vessels did not contribute to deck runoff. However, on the MCM 1 Class vessels, a small amount of cleaning compound is used to clean navigational system components and could contribute to deck runoff.

Equipment and vehicle washdowns may contribute dirt, salt residue, oil and grease, and cleaning compounds to deck runoff. Although most cleaning evolutions are performed outside 12 nm, residuals trapped in rough deck surfaces may contribute to deck runoff within 12 nm.

Frequency and types of exterior topside surface washdowns vary with vessel class and geographic location (inside/outside 12 nm). When in port, the effluent is either collected and contained for disposal or discharged directly overboard according to standard operating procedure for USCG, . When underway, several cleaning protocols are used. They include flight deck and hangar deck SCRUB X exercises (see Section 4.4.2 for detailed explanation) and a mechanical flight deck scrubber. Flight deck and hangar deck SCRUB X exercises occur well outside 12 nm and the mechanical flight deck scrubber removes any residual solution. The washdown effluent may contain salt residue, rust, oil and grease, traces of fuel, soot, hydraulic fluid, aircraft tire residue, paint chips, cleaning compounds, and other materials. This solution is then discharged overboard.

Finally, the firemain system, which supplies water for some deck cleaning activities, does contribute to deck runoff. However, the constituents contributed by this system are being evaluated separately under UNDS (EPA and DOD, 1999).

4.1 AIRCRAFT WASHDOWN

Aircraft washdowns include cleaning the exterior surfaces and engines of fixed wing and rotary wing aircraft. Aircraft washdowns remove dirt, salt, hydraulic fluid (MIL-PRF-83282D), lubricating oil (MIL-PRF-23699FF), and grease (MIL-PRF-23827C and MIL-PRF-81322F).

Aircraft hydraulic fluid (MIL-PRF-83282D) consists of more than 65 % of synthetic hydrocarbon base oil and less than 35 % of lubricant ester base. Aircraft grease (MIL-PRF-81322F) is mostly a complex mixture of paraffinic, napthenic and aromatic hydrocarbons, while MIL-PRF-23827C grease is 75 % to 85 % synthetic ester, 10 % to 15 % lithium 12-hydroxystearate, 1 % to 2 % antimony dialkyldithiocarbamate, and 1 % p,p'-dioctyldiphenylamine.

Exterior surfaces of fixed wing aircraft are cleaned with freshwater and a solution of aircraft cleaning compound (MIL-PRF-85570C Type II, see table 4-3 for bulk constituents). On aircraft carriers (CV and CVN Class designation), fixed wing aircraft are washed every 14 days, while on amphibious assault vessels (LHD 1 and LHA1 Classes), fixed wing aircraft are washed every 7 days. The wastewater and cleaning solution is continuously vacuumed from the deck while the washdown is conducted. All washdown wastewater is subsequently discharged overboard when the vessel is operating outside 12 nm. Because aircraft depart the vessel before it transits within 12 nm, fixed wing aircraft are not washed inside 12 nm.

A complete freshwater washdown of Navy rotary wing aircraft is performed every seven days (Wenzel, 2000e; Wenzel *et al*., 2001b, 2001c). The washdown procedure calls for approximately 8 oz of aircraft cleaning compound (MIL-PRF-85570C Type II) for every 1 gal of freshwater. The aircraft is wetted down and rinsed using an unknown quantity of freshwater. The washwater and aircraft cleaning compound mixture drains directly overboard. Before and after rotary wing aircraft washdowns, all aircraft fittings are greased.

USCG rotary wing aircraft are washed every day while underway with a solution of VCI-415 cleaning compound in freshwater (U.S. Coast Guard, 2000a, 2001a). The aircraft is wetted down and rinsed using less than 500 gal of water. The USCG WAGB 420 and 399, WHEC 378, WMEC 270, and WMEC 210 Class cutters (42 total) do operate within 12 nm. However, their operational time within 12 nm is less than 10 % of their total underway operational time. Each WHEC and WMEC cutter typically carries one rotary wing aircraft onboard, WAGBs typically carry two. The wastewater generated drains directly overboard.

All USCG and most Navy vessels that are expected to accommodate two or less rotary wing aircraft are designed with a flight deck that can only accommodate one of the aircraft at a time. If the vessel carries a second aircraft, it must remain in the hangar while there is an aircraft on the flight deck. The aircraft on the flight deck is positioned above a device called a "TALON" grid. This is the position that the aircraft must takeoff and land from. Additionally, any maintenance not conducted in the hangar, is conducted in this position. The TALON grid is an approximately 10 ft to 16 ft diameter circular and flush deck grid that the aircraft's hold-down device hooks into. The grid has a cavity beneath it that drains directly overboard. The grids are always greater in diameter than the aircraft's fuselage. Therefore, any constituents that may drip from the aircraft's fuselage, forward landing gear, or result from fuselage/engine washing or refueling activities, drip/drain directly into the TALON grid cavity. Washwater from those areas of the aircraft (nose and tail sections) that are not over the TALON grid does end up on deck. However, these sections do not contribute constituents of significance because of their enclosed and limited machinery. Due to the vessel motion experienced by these smaller vessels, and the closeness of the aircraft to the deck drains, aircraft washwater quickly drains overboard. One example is the WHEC 378 foot cutter, which has a beam (width) of only 38 feet. With the aircraft centered over

the TALON grid, the aircraft washwater needs to travel less than 19 feet to reach the deck edge, and less than that to reach a drain. On these smaller vessels, aircraft washwater (which may contain soap or other constituents) on the deck, combined with vessel motion create an unsafe work environment for personnel. The crew typically rinses any aircraft washwater, left on deck at the conclusion of the aircraft wash, to the deck drains or deck edge (Volpe, 2002b).

The difference between Navy and USCG rotary wing aircraft washdown schedules is due to their different operating profiles. USCG vessels that carry rotary wing aircraft are typically much smaller than Navy vessels that carry rotary wing aircraft. Because USCG vessels are smaller than Navy air capable vessels and often lack a hangar, the aircraft are exposed to more sea spray than on larger vessels. To prevent premature corrosion of vital aircraft components, the aircraft on USCG vessels are washed more frequently than on Navy vessels.

Fixed wing and rotary wing aircraft engines are cleaned with cleaner MIL-C-87937D (a mixture of 1 % to 5 % 2-butoxyethanol, 1 % to 5 % cyclohexanol, and 20 % to 40 % aromatic hydrocarbons) or gas path MIL-C-85704C Type I or IIA cleaner (a mixture of approximately 10 % dipropylene glycol methyl ether, 10 % hexylene glycol and unknown amounts of heavy aromatic naphtha, triethanolamine, and nonylphenol polyethoxate), both of which are mixed with water. Rotary wing aircraft engines and rotors are rinsed with freshwater after each flight. The frequency of engine wash with gas path cleaner depends on the type of aircraft and vessel location. Although USCG rotary wing aircraft engines may be washed within 12 nm of the U.S. coast, the vast majority of those washes occur outside 12 nm because when USCG vessels are operating within 12nm they typically do not have aircraft embarked. Fixed wing aircraft engines are cleaned outside 12 nm. Appendix L of OPNAVINST 5090 (Navy, 1999) explicitly states that wastewater from aircraft engine washdowns can only be disposed overboard when outside 12 nm. Navy aircraft engine waterwash produced within 12 nm must be containerized for shore disposal.

Aircraft washdown evolutions were observed and documented during the AOE 6, CV/CVN 68, and LHD 1 Class shipboard assessments. The following sections cover class specific characterizations, whereas the previous paragraphs describe the possible constituents that could contribute to deck runoff in general. The following sections are based upon findings by the survey team, and although not necessarily representative of all vessels in a particular class, these findings are assumed to be representative unless otherwise noted.

4.1.1 AOE 6 Class

For the AOE 6 Class of auxiliary support vessels, aircraft washdowns are dependent upon flight operations and location. Freshwater washes are performed after all flights over salt water to remove salt deposits. These freshwater washdowns focus on the windshield and rotor assembly, and normally take only 2 min using a 0.75 in garden hose at 20 psi with a nozzle attached. Although the hose is equipped with an on/off nozzle, it is left in the “on” position so the crewmember can spray the helicopter as they walk from the front to the back of the aircraft. A complete freshwater washdown is performed every 7 days. However, if operations are conducted in the Persian Gulf region, the helicopters are washed every 3 days due to the accumulation of sand on the aircraft. When a complete washdown is performed, the aircraft is washed using approximately 8 oz of MIL-C-87937D aircraft cleaning compound mixed with 1 gal of freshwater. If the aircraft is extremely dirty, two gal of the solution (or 16 oz of MIL-C-87937D)

may be required. During complete washes, the freshwater is applied using a 150 psi pressure washer and a 0.75 in garden hose. The washwater/aircraft cleaning compound mixture drains directly overboard. While on the AOE 6 Class, the survey team observed the crew capturing a portion of the washwater from the top of the aircraft to wash the lower portion of the aircraft (Wenzel *et al*., 2001a).

Upon returning from each flight, a freshwater rinse is performed on the engines and rotors to remove salt accumulation. The helicopter engines are washed every 25 hr of flight operation and every 14 hr when operating at-sea. The engines are washed with a mixture of MIL-C-85704C aircraft cleaning compound and freshwater. This mixture is poured over and into the engine, and then flushed with freshwater until all visible signs of soap are removed from the engine compartment. The runoff travels down the side of the aircraft directly onto the helicopter deck (Wenzel *et al*., 2001a).

Because the aircraft are not onboard when the vessel is operating in the contiguous zone, the discharges generated as a direct result of aircraft washdown are not regulated by UNDS. However, residual MIL-C-87937D and MIL-C-85704C that have become trapped in the rough deck surface have the potential to subsequently become entrained in rainfall and contribute to deck runoff within 12 nm (Wenzel *et al*., 2001a).

4.1.2 CV/CVN 68 Class

For the CV/CVN 68 Class, both rotary and fixed wing aircraft washdowns are dependent on operational tempo (i.e., rate of operations or aircraft activities) and vessel location. While the aircraft are attached to the vessel and in an underway operating status, a complete freshwater washdown is performed every 14 days, with the exception of the SH-60 helicopter that is washed every 7 days. Spot washing is conducted daily, as required, using an aerosol aircraft cleaning compound (mil spec unavailable). When a complete washdown is performed, the aircraft is washed using aircraft cleaning compound MIL-PRF-85570C Type II. Freshwater is supplied using a 0.75 in garden hose with a spray nozzle attached. Approximately 100 gal to 150 gal of water are used per aircraft. MIL-PRF-81322F grease is applied via the grease fittings prior to the washdown evolution to expel old grease and again after the washdown to expel grease contaminated with the washwater. Based on laboratory testing conducted by the survey team, the survey team estimated that in excess of 1 g of grease is expelled each time the grease gun is pumped. The crew told the survey team that aircraft grease fitting is lubricated by pumping the grease gun 3 – 4 times; therefore, the survey team concluded that approximately 4 g to 5 g of grease is used per fitting prior to and after each washdown for a total of approximately 8 g to 10 g per fitting per washdown. The expelled grease falls to the flight deck and is recovered with the washwater and discharged overboard with the washwater outside 12 nm (Wenzel *et al*., 2001a).

For all fixed wing aircraft, all aircraft engines are cleaned by washing the engines with MIL-C-85704C gas path cleaner. After completing the engine wash, the engines are rinsed using freshwater. The freshwater is supplied from the vessels' freshwater system using a 0.75 in garden hose with spray nozzle attached. To prevent the water and gas path cleaner from spreading to other areas of the flight deck resulting in unsafe conditions, the crew uses wet vacuums to contain this washwater. This water/detergent mixture is subsequently discharged overboard. As previously noted, these operations are conducted outside 12 nm (Wenzel *et al*., 2001a).

For all rotary wing aircraft, engines are washed using MIL-C-85704C gas path cleaner every 60 hr of flight operations. The engines are rinsed using freshwater. The freshwater is supplied from the vessels' freshwater system using a 0.75 in garden hose with spray nozzle attached. Although the gas path cleaner and rinse water run onto the flight deck, squadron personnel use wet vacuums to prevent the water and cleaning solution from spreading to other areas of the flight deck resulting in unsafe conditions. This water/detergent mixture is subsequently discharged overboard outside 12 nm (Wenzel *et al*., 2001a).

Although all aircraft disembark when the vessel is well beyond the contiguous zone, MIL-PRF-81322F aircraft grease and MIL-PRF-85570C aircraft cleaning compound may become trapped in the rough deck surface after exterior topside surface washdown. Subsequently, this residual matrix may contribute to deck runoff within 12 nm (e.g., during rain events) (Wenzel *et al*., 2001a).

4.1.3 LHD 1 Class

For the LHD 1 Class, aircraft washdowns are dependent upon the vessel's location and operational tempo. Freshwater washes are performed daily, when underway, to remove salt deposits. The washdown lasts 2 min and is performed using a 0.75 in garden hose at 20 psi with a spray nozzle attached. A freshwater rinse is also performed on aircraft that have flown over water at altitudes less than 500 ft for extended periods. MIL-PRF-81322F grease is applied via the grease fittings prior to the washdown to expel old grease and again after the washdown to expel grease contaminated with the washwater. Based on laboratory tests and observations, the survey team determined that approximately 8 g to 10 g of grease is used per fitting; each helicopter has 10 grease fittings. The expelled grease falls to the flight deck and is discharged overboard with washwater outside 12 nm (Wenzel *et al*., 2001a).

Each aircraft receives a complete freshwater washdown every 7 days. During the complete washdown of an AH-1 aircraft, the crew mixed approximately 8 oz of MIL-PRF-85570C aircraft cleaning compound with three gal of freshwater, and applied the mixture to the aircraft using long telescoping poles with a flat scrubbing head. A 0.75 in garden hose with a spray nozzle attached was used to wet and rinse the aircraft. The entire process took 40 min, with the water running for 14 min. The wastewater drained directly overboard (Wenzel *et al*., 2001a).

For all fixed wing aircraft, the engines are washed every 25 hr of flight operations using MIL-C-85704C gas path cleaner and water solution. The mixture is poured over and into the engine, and then flushed with freshwater until all visible signs of soap are removed from the engine compartment. A pneumatic wet vacuum cleaner is used to contain and recover the cleaning compound/water mixture; the recovered mixture is subsequently discharged overboard. These operations are conducted outside 12 nm (Wenzel *et al*., 2001a).

Rotary wing aircraft engines are also cleaned using MIL-C-85704C gas path cleaner. The mixture is poured over and into the engine, and then flushed with freshwater until all visible signs of soap are removed from the engine compartment. A pneumatic wet vacuum cleaner is used to contain and recover the cleaning compound/water mixture that is subsequently discharged overboard outside 12 nm (Wenzel *et al*., 2001a).

Although aircraft disembark when the vessel is well beyond the contiguous zone, MIL-PRF-85570C aircraft cleaning compound and MIL-PRF-81322F grease may become trapped in the rough deck surface and subsequently contribute to deck runoff within 12 nm (e.g., during rain events) (Wenzel *et al.*, 2001a).

4.1.4 Cleaning Compounds

Aircraft washdown was observed on the AOE 6, CV/CVN 68, and LHD 1 class vessels. MIL-PRF-81322F grease is applied via the grease fittings prior to the washdown evolution to expel old grease and again after the washdown to expel grease contaminated with the washwater. Based on laboratory tests and observations, the survey team determined that each aircraft grease fitting is lubricated with approximately 4 g to 5 g of grease both prior to and after the washdown, for a total of approximately 8 g to 10 g of grease per fitting per washdown. The aircraft washdown data are shown in the following tables.

Table 4-1— Estimated Quantities of Grease Fittings and Cleaning Compounds per Aircraft Washdown

Vessel Class	Aircraft Type	Number of Grease Fittings	Cleaning Compound	Cleaning Compound Amount
AOE 6 Class	All aircraft	10	MIL-C-87937D	8 oz/gal of water
CV/CVN 68 Class	F-14	85	MIL-C-81302 Type II	2.5 gal
CV/CVN 68 Class	F/A-18	60	MIL-C-81302 Type II	1.5 gal
CV/CVN 68 Class	S-3	100	MIL-C-81302 Type II	2.5-3 gal
CV/CVN 68 Class	SH-60	10	MIL-C-81302 Type II	32 oz
LHD 1 Class	All aircraft	Unknown	MIL-PRF-85570C, Type II	0.5 gal/5 gal of water

Note: Engine washes and rinses are conducted based on the number of hours the engines are operated. This cleaning evolution varied in frequency depending on the type of aircraft. All engines were washed using a mixture of gas path (TURCO 5484) MIL-C-85704C, Type I or Type IIA gas turbine cleaner and water followed with freshwater rinses. The amount of gas path cleaner used varied with engine type as listed below. The water and cleaning solutions from both processes drained to the deck and overboard outside 12 nm.

Table 4-2— Estimated Quantities of Discharge per Aircraft for Each Aircraft Washdown

Aircraft Type	Cleaning Compound Solution
F-14	10 gal/aircraft
F/A-18	5 gal/aircraft
AV-8	1.5 gal/ aircraft
S-3	3 gal/ aircraft
EA-6B	4 gal/ aircraft
EC-2	5 gal/ aircraft
SH-60	1.5 gal/ aircraft
UH-1	1 gal/ aircraft
AH-1	1 gal/ aircraft
CH/MH-53	2.25 gal/ aircraft
CH-46	1 gal/ aircraft

Note: The majority of airframe and engine wash evolutions are conducted outside of the contiguous zone. However, residual cleaning compounds may become trapped in the non-skid surfaces of the flight decks and subsequently discharged overboard during a rainfall event in the contiguous zone. Following aircraft departure, all vessels surveyed conducted a total exterior topside surface washdown while outside the contiguous zone. The amount of cleaning compounds used for aircraft and engine washdown that contributes to deck runoff within 12 nm was residual and could not be estimated.

Table 4-3— Potential Discharge Materials for Aircraft Washdown

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Aircraft Cleaning Compound, MIL-C-87937D	Unknown	2-Butoxyethanol	111726	1 - 5	Unknown	None
		Cyclohexanol	108930	1 - 5	Unknown	None
		Aromatic hydrocarbons	64742945	20 - 40	Unknown	Unknown
Aircraft Cleaning Compound, MIL-PRF-85570C, Type II	Unknown	Dipropylene glycol methyl ether	34590948	10	Unknown	None
		Morpholine	110918	0.5	Unknown	None
		Ethoxylated nonylphenol	—	Unknown	Unknown	None
		Alkanolamide	—	Unknown	Unknown	None
Hydraulic Fluid, MIL-PRF-83282D	Unknown	Synthetic hydrocarbon based oil	—	> 65	Unknown	Unknown
		Ester based lubricant	—	< 35	Unknown	Unknown
Lubricating Oil, MIL-PRF-23699F	Unknown	Polyol esters	—	100	Unknown	Unknown
Grease, MIL-PRF-23827C	Unknown	Synthetic ester	—	75 - 85	Unknown	None
		Lithium 12 hydroxystearate	7620771	10 - 15	Unknown	None
		Antimony dialkyldithiocarbamate	15890252	1 - 2	Unknown	None
		p,p'-Dioctyldiphenylamine	101677	1	Unknown	None
Grease, MIL-PRF-81322F	Unknown	Mixture of paraffinic, naphthenic, and aromatic hydrocarbons	—	Unknown	Unknown	None
Gas Path Cleaner, MIL-C-85704C	Unknown	Dipropylene glycol methyl ether	34590948	10	Unknown	None
		Hexylene glycol	107415	10	Unknown	None
		Heavy aromatic naphtha	64742945	Unknown	Unknown	None
		Triethanolamine	102716	Unknown	Unknown	None
		Nonylphenol polyethoxate	9016459	Unknown	Unknown	None

Table 4-4— Narrative Parameters for Aircraft Washdown

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Colloidal Matter	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Unknown-not evaluated
Hardness	Unknown-not evaluated
Nutrients	Unknown-not evaluated
Odor	Unknown-not evaluated
Oil and Grease	None observed, no sheen noted
Pathogens	Unknown-not evaluated
PH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Does not change temperature
Total Dissolved Gases	Unknown-not evaluated
Turbidity	Unknown-not evaluated

The need for the information in this table was not recognized at the time of the assessment. The information is based on assessment survey team recollection and consensus.

4.2 ELECTRONIC INTELLIGENCE/NAVIGATION SYSTEMS MAINTENANCE

Process information on the electronic intelligence/navigational systems was obtained during the AOE 6, DDG 51, MCM 1, WLM 175, and WPB 110 shipboard assessments. Due to the self-contained radar, no maintenance is performed except to determine oil levels and grease levels. Whip, or flexible unstayed antenna maintenance is limited to applying small amounts of silicone to the couplers and applying a sealing compound that hardens in 24 hr. Preservation and painting is limited to touch up painting. With the exception of the MCM 1 Class, electronic intelligence and search/navigational systems do not contribute to deck runoff. The MCM 1 Class vessels clean the surface search and navigation radar rotating assemblies with freshwater and a small amount of a cleaning compound (Simple Green^{TM}), which has the potential to contribute to deck runoff.

4.3 EQUIPMENT AND VEHICLE WASHDOWNS

Vessels can carry and transport a variety of different equipment and vehicles. These vehicles can be used as part of the vessel's normal operations (e.g., aircraft towing tractors) or the vehicles can be cargo (e.g., tanks). This equipment is washed frequently to prevent build up of salt from sea spray. The constituents from equipment and vehicle washdowns that contribute to deck runoff include salt residue, dirt, oil, grease, and cleaning compounds. Most Navy and USCG equipment and vehicle washdowns are performed outside 12 nm, however some residue remains trapped in the rough deck surface and may contribute to deck runoff inside 12 nm (Wenzel, 2000e; Wenzel *et al*., 2001b, 2001c).

A diverse assemblage of U.S. Army vessel classes may carry and transport vehicles on the weather deck. These vessel classes include, but are not to limited to, landing craft (e.g., LCM 8, and LCU 2000), non-powered barges, and logistic support vessels (LSV). Transported vehicles are normally part of the vessel's cargo (e.g., tanks, and humvees). War fighting ground equipment/cargo is always taken to a land-based wash rack for washdowns. Any petroleum product that might fall from the war fighting ground equipment/cargo to the deck is immediately cleaned up. However, residual petroleum products may become trapped in the rough deck surface and have the potential to contribute to deck runoff (Legge, 2002b). The materials that have the potential to contribute to deck runoff include: MIL-PRF-2104G and MIL-PRF-2105E lubricating oil, MIL-G-10924G automotive and artillery grease, MIL-PRF-46170C fire resistant hydraulic fluid, MIL-L-23549 general purpose grease, MIL-G-18458B wire rope grease, and SAE AS8660 silicone compound. The following table lists these compounds and their bulk constituents.

Table 4-5— Potential Discharge Materials for Equipment and Vehicle Washdowns

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Lubricating Oil, MIL-PRF-2104G	Unknown	Petroleum hydrocarbons	—	Unknown	Unknown	Unknown
Lubricating Oil MIL-PRF-2105E	Unknown	Petroleum hydrocarbons	—	Unknown	Unknown	Unknown
Wire Rope Grease, MIL-G-18458B	Unknown					
		Phosphorous (Yellow)	7723140	Unknown	Unknown	None
		Petroleum carriers	—	Unknown	Unknown	Unknown
General Purpose Grease, MIL-G-23549	Unknown	Petroleum hydrocarbons	—	Unknown	Unknown	Unknown
Automotive and Artillery Grease, MIL-G-10924G	Unknown	Petroleum hydrocarbons	—	100	Unknown	Unknown
Fire Resistant Hydraulic Fluid, MIL-PRF-46170C	Unknown	Synthetic hydrocarbon base oils	68649127	60 - 65	Unknown	Unknown
		Synthetic esters	—	25 - 30	Unknown	Unknown
		Barium dinonylnaphthalene sulfonate	25619561	2 - 3	Unknown	None
		Tricresyl phosphate	1330785	1 - 2	Unknown	None
Silicone Compound, SAE AS8660	Unknown	Dimethylpolysiloxane	63394025	90	Unknown	None
		Silica	112945525	10	Unknown	None

4.4 EXTERIOR TOPSIDE SURFACE WASHDOWN

The survey team gathered exterior topside surface washdown information during all vessel assessments. Exterior topside surface washdowns include cleaning all exterior surfaces and maintaining their cleanliness. The washdown effluent may contain dirt, rust, salt, paint chips, hydraulic fluid, fuel, lubricating oil, greases, soot, cleaning compounds, and other materials. The frequency and types of cleaning evolutions vary with vessel class and geographic location (inside/outside 12 nm) but is detailed below.

4.4.1 AOE 6 Class

The survey team observed the crew sweeping the deck throughout the day as part of their daily routine. The decks are swabbed using freshwater and small amounts of general purpose cleaner (MIL-D-16791G). Additionally, the survey team observed the crew swabbing all weather decks immediately after each rain squall using only the rainwater on the weather deck (no cleaning compounds). This practice is indicative of the proactive approach the command takes to ensure the vessel remains clean using all available resources. Due to the small amount of cleaning compound used, the survey team concluded that cleaning does not contribute to deck runoff.

When underway at distances greater than 25 nm from shore, the crew washes the deck once a week with freshwater. When in port, the deck is swept and swabbed only, therefore no effluent is generated. The crew uses corn brooms and scrub brushes to clean the deck with a solution of MIL-D-16791G general purpose detergent and freshwater. Approximately 1.5 gal of the general-purpose detergent is used to clean the entire vessel. The washdown evolution for the entire vessel (except helicopter deck) takes approximately 6 hr with the water running approximately 50 % of the time. The helicopter deck is cleaned with the same detergent/water mixture using a 0.75 in garden hose at 20 psi without a nozzle and requires approximately 25 min. The survey team collected information on this process by interviewing fleet personnel. The amount of time and detergent used when conducting the washdown was provided by crewmembers participating in the vessel washdown. Due to harsh weather conditions, a washdown was not performed while the survey team was on the ship. Therefore, the survey team was unable to observe and document a washdown; exact times and generation rates for washdowns are not known. The survey team observed the crew swabbing the deck immediately after each rainsquall using only the rainwater (no detergent) remaining on the deck surface, thereby cleaning the deck, and reducing the vessel's freshwater usage. Because scheduled non-rain squall washdowns occur outside 25 nm, the only contaminants entering surrounding waters inside the contiguous zone are residual contaminants that become trapped in the rough deck surface and subsequently discharged overboard within 12 nm (e.g., during a rainfall event) (Wenzel *et al*., 2001a).

Materials used during aircraft maintenance and engine cleaning have the potential to become trapped in the rough deck surface and subsequently contribute to deck runoff within 12 nm. However, because the deck surfaces are typically cleaned outside the 12 nm limit, only residual constituents may be discharged within 12 nm.

4.4.2 CV/CVN 68 Class

Two separate assessments were conducted aboard a CV/CVN 68 Class vessel. The first assessment was conducted after the vessel had been at sea, conducting flight operations for two months. The second assessment was conducted following six months of at-sea flight operations. The objective of the second assessment was to document preparations taken to ensure flight deck cleanliness prior to the vessel entering the contiguous zone at the end of a six-month deployment. During both assessments, the survey team expected to find an accumulation of jet fuel, grease, and oil on the flight deck; however, observations revealed that most of the stains on the deck were tire residue from the thousands of aircraft launch and recovery evolutions with limited staining from fuel, grease, and oil residue.

Flight deck cleanliness is a safety issue. Liquid remaining on the flight deck can be drawn into the aircraft intake and be as damaging to an aircraft as a solid object. The vessel maintains constant and tight control over flight deck cleanliness by providing detailed written instructions and recording cleaning evolutions. These are a part of the air detachment standard operating procedures. The details of the actual execution of the cleaning evolutions may vary from vessel to vessel, but the general nature of the procedures is similar for all vessels in the fleet.

The survey team observed and documented a section of the flight deck being cleaned during the survey team's first night at sea. Survey team members recorded all maintenance actions performed on the area for four days, then visually examined the area to identify potential contaminants. Stains caused by materials leaked onto the deck and absorbed by the non-skid deck surface were visible. During the four-day period, 100 aircraft refueling evolutions, eight aircraft engine washes, and 60 routine maintenance processes (e.g., change tires, service hydraulic system, etc.) were performed on this section of the deck.

Following is a synopsis of observations made during the two at-sea assessments (Wenzel *et al*., 2001a).

First At-Sea Assessment. It was readily evident that the crew was successful in maintaining flight deck cleanliness. The crew used two methods to clean the flight deck: a nightly scrubbing exercise referred to as a "SCRUB-X", and continuous cleaning using a mechanical flight deck scrubber.

- *SCRUB-X*. At the beginning of the deployment, a diagram was developed to divide the flight deck into eight sections. Each embarked air squadron is responsible for one section. The sections are cleaned on a rotational basis. A logbook, that identifies the responsible squadron and records when each section is cleaned, is maintained in Flight Deck Control.

  One section of the flight deck is scrubbed each night after flight operations. During a SCRUB-X, the deck is wetted with seawater supplied by the vessel's firemain (95 psi), via a 2.5 in fire hose. After the deck is wet, approximately 5 gal of B&B 88 cleaning compound (see Table 4-6) is spread onto the deck to be cleaned. Approximately 20 – 30 sailors use push-style brooms with long, stiff bristles to "scrub" the flight deck. The sailors form a line and scrub the deck with the brooms, making 10 – 15 horizontal and 10 – 15 passes perpendicular to the original passes. The deck is sprayed with seawater to

remove residual soap. The remaining cleaner/water mixture is suctioned into the flight deck scrubber's recovery tank and discharged overboard. The nightly SCRUB-X requires 1 hr to 1.5 hr to clean a 120 ft by 80 ft section, depending on material accumulation.

Each morning before flight operations begin, squadron personnel use pneumatic vacuums to remove liquids and other foreign objects from the aircraft tie-down fixtures located in their assigned section of the flight deck. When this task has been completed, the date, time, and responsible individual are recorded in the logbook.

- *Mechanical Flight Deck Scrubber*. A flight deck scrubber equipped with a vacuum system that recovers residual solution is used to clean the flight deck and remove standing water. The scrubber is a one-person rider type and is equipped with a portable vacuum wand that is used to clean areas inaccessible to the scrubber, two hydraulically powered scrub brushes, a 140 gal solution tank, and a 120 gal recovery tank. The crew creates a cleaning solution by mixing 0.5 gal of a cleaning compound (Simple Green™) and 140 gal of water. The scrubber applies the cleaning solution in front of dual high-speed opposed rotation brushes. The brushes scrub the soiled area and sweep-up debris. The dirty water and debris is contained by the rear vacuum squeegee and suctioned into the recovery tank. The recovered cleaner/water mixture is poured overboard. The survey team noted that the flight deck scrubber was used daily during and between scheduled flight operations to maintain a high level of cleanliness.

Second At-Sea Assessment. A second assessment was conducted at the end of a six-month deployment to observe and document a SCRUB-X of the entire flight and hangar decks. The SCRUB-X was conducted after the air wing disembarked and the vessel was 200 nm from land. Because the vessel had launched and recovered more than 10,000 aircraft during its deployment, there was a significant accumulation of tire residue, but not hazardous constituents.

- *Flight Deck SCRUB-X*. The entire flight deck was cleaned with B&B 88 flight deck cleaner using seawater supplied by the vessel's firemain at 95 gpm through a 2.5 in fire hose. The cleaner was applied to the flight deck from a 55 gal drum using a foaming nozzle. Approximately 40 scrubbers made numerous horizontal passes followed by numerous passes perpendicular to the original passes over each section of the deck. Following the scrubbing, the deck was sprayed with seawater to remove residual soap and tire residue. The cleaner/water/debris mixture flowed directly overboard. Ten drums of cleaner were used to wash the entire flight deck. The survey team observed that the hoses were in use for approximately 23 min to clean a 31,000 ft^2 (approximate) section of the flight deck, resulting in the use of approximately 2,185 gal of water. This section represents 15 % of the entire flight deck area.

- *Hangar Deck SCRUB-X*. The hangar deck (the deck where the aircraft are stored and aircraft maintenance is performed) SCRUB-X also occurred approximately 200 nm from land immediately after the air wing disembarked. A 55 gal drum of B&B 88 cleaning compound was placed on a forklift, punctured, and the forklift was driven around the hangar bay to disperse the contents. Concurrently, freshwater, supplied at 95 gpm through a 1.5 in fire hose, was sprayed on the deck. Approximately 25 sailors used push-style

brooms with long, stiff bristles as scrubbing devices and made several horizontal passes followed by numerous passes perpendicular to the original passes over sections of the deck prior to spraying the deck with freshwater to remove residual soap and constituents. The cleaner/water/constituent mixture flowed directly overboard. Six 55 gal drums of cleaning compound were used to clean the hangar deck.

Flight and hangar deck scrubbing exercises occur well beyond (> 200 nm) the contiguous zone. Nonetheless, residual cleaner and constituents may dry on the deck surface or become trapped in the non-skid material and subsequently contribute to deck runoff within 12 nm.

Fixed wing and rotary wing aircraft maintenance materials that have become trapped in the rough deck surface (including MIL-PRF-83282D aircraft hydraulic fluid; MIL-PRF-81322F aircraft grease; and MIL-C-85704C gas path cleaner) have the potential to subsequently contribute to deck runoff within the contiguous zone. However, the deck surfaces are cleaned outside 12 nm; therefore only residual constituents are expected to contribute to the discharge within 12 nm.

4.4.3 DDG 51 Class

An assessment was conducted on a DDG 51 Class vessel when the vessel was pierside. Because the vessel was pierside, the decks were swabbed using mops and a small amount of freshwater (no detergent); care was taken to prevent the water from flowing overboard. During the assessment, all dirt and debris were swept and containerized. It is important to note that when a vessel is in port, the weather deck is normally swept several times a day. As a result of the crew's attention to cleanliness, the potential for topside debris to enter surrounding waters while the ship is in port is minimized.

The deck is washed weekly when the vessel is underway. When underway, the washdown occurs beyond 12 nm of shore and requires approximately 2 hr to clean all weather deck surfaces. A solution of approximately 1 pt of MIL-D-16791G general-purpose detergent is mixed with freshwater supplied by the vessel's 50 psi to 70 psi freshwater system. The washdown process begins with wetting the deck with a 0.5 in garden hose (without an on/off nozzle). The water/detergent solution is lightly dispersed on the deck, and the deck is scrubbed with brooms and brushes. Upon completion of the scrubbing evolution, the garden hose is used to rinse the water/detergent/constituent mixture from the deck. Because detergents are not used when the vessel is in port and the deck is swept several times a day, only minimal amounts of residual soap and debris have the potential to contribute to deck runoff as a result of exterior topside surface washdowns within 12 nm (Wenzel, 2000b).

4.4.4 LHD 1 Class

Although the shipboard assessment was conducted while the vessel was underway, a flight deck washdown was not conducted while the survey team was aboard the LHD 1 Class vessel; however, the crew was interviewed and the process discussed. The crew indicated that the flight deck is cleaned via two methods: a scrubbing exercise (SCRUB-X) and a mechanical flight deck scrubber (Wenzel *et al.*, 2001a).

SCRUB-X. During a SCRUB-X, a cleaning compound is spread onto the flight deck after it has been wetted with seawater supplied from the vessel's firemain. Approximately 20 –

30 sailors use push-style brooms with long, stiff bristles to "scrub" the flight deck. The sailors form a line and scrub the deck with the brooms, making 10 – 15 horizontal passes followed by 10 – 15 passes perpendicular to the original passes. The deck is sprayed with seawater to remove residual soap. The remaining cleaner/water mixture is suctioned into the flight deck scrubber's recovery tank and poured overboard. The procedure is the same for a hangar deck SCRUB-X except freshwater is used.

The LHD 1 Class vessel had been at-sea for three months and had conducted two flight deck scrubbing exercises concurrent with scheduled testing of the firemain system. Each SCRUB-X lasted 6 hr to 8 hr, with the water from the vessel's firemain in use 50 % of the time. Visual observations made during the assessment revealed that the flight deck remained stained with tire, grease, and oil residue.

Flight Deck Scrubber. All LHD 1 Class vessels are equipped with a mechanical flight deck scrubber. The flight deck scrubber is a one-person rider type and has a vacuum system that provides suction for residual solution recovery, a portable vacuum wand that is used to clean areas inaccessible to the scrubber, two hydraulically powered scrub brushes, a solution tank, and a recovery tank. The scrubber applies the cleaning solution in front of dual high-speed opposed-rotation brushes. The brushes scrub the soiled area and sweep-up debris. The dirty water and debris are contained by a rear vacuum squeegee and suctioned into the recovery tank. The recovered cleaner/water mixture is discharged overboard.

The LHD 1 assessment provided survey team members the opportunity to compare the LHD flight deck conditions and best management practices to those observed and documented aboard the CV/CVN 68 Class carrier. The LHD 1 Class had 5 fixed and 24 rotary wing aircraft with a moderate operating tempo. The CV/CVN 68 Class had 62 fixed and 7 rotary wing aircraft with a busy operating tempo. Although the CV/CVN 68 Class had far more aircraft and a heavier operating schedule than the LHD 1 Class, the CV/CVN 68 Class vessel decks were significantly cleaner. To achieve and maintain flight deck cleanliness, the CV/CVN 68 Class crew manually scrubbed a section of the flight deck daily. In addition, a mechanical flight deck scrubber was continuously in use onboard the CV/CVN 68 Class vessel both during and after air operations. The survey team was onboard the LHD for six days and did not observe the flight deck scrubber in use, nor was the flight deck manually scrubbed (Wenzel *et al*., 2001a).

LHD 1 Class flight deck personnel stated that it is routine practice for all air capable vessels to conduct a thorough SCRUB-X of the flight and hangar decks using B&B 88 flight deck cleaner at the end of a deployment and prior to entering the contiguous zone. Although flight and hangar deck scrubbing exercises occur outside the contiguous zone only, residual cleaner may dry on the deck surface or become trapped in the non-skid material and subsequently contribute to deck runoff discharge within 12 nm (Wenzel *et al*., 2001a).

Materials used during fixed and rotary wing aircraft maintenance and engine cleaning (MIL-PRF-83282D aircraft hydraulic fluid and MIL-C-85704C gas path cleaner) have the potential to become trapped in the rough deck surface and subsequently contribute to deck runoff discharge

within the contiguous zone. However, the deck surfaces are cleaned outside the 12 nm limit and therefore there would only be residual constituents in the discharge within 12 nm.

4.4.5 MCM 1 Class

The weather decks of both MCM 1 Class vessels assessed by the survey team were remarkably clean. As a result of all the mine sweeping and handling equipment being located topside, the deck surface area that is washed is significantly smaller than other war vessels in the same platform category. The frequency of exterior topside surface washdowns is dependent upon the amount of saltwater accumulation. Washdowns are normally conducted once every three weeks. Approximately 60 % of washdowns are conducted pierside, 20 % within the 0 – 3 nm range and 20 % within the 3 – 12 nm range. The crew described two types of washdown evolutions: rinses and full washdowns. Rinses are conducted using a 0.5 in garden hose with a water pressure of 35 psi to 60 psi; the nozzle is normally left open so the water runs continually. No cleaning compound is used during a rinse. Full washdowns are conducted using approximately 2 gal of cleaning compound (Simple Green™). The crew prefers to conduct full washdowns while the vessel is in port receiving pierside services. The full washdown evolution takes approximately 2.5 hr using a 0.5 in garden hose with a water pressure of 35 psi to 60 psi; the nozzle is normally left open so the water runs continuously. If a full washdown is conducted when underway, the water pressure is 55 psi to 65 psi and an on/off nozzle is used to conserve the vessel's freshwater supply. The crew scrubs the deck with corn brooms, scrub brushes, and detergent during a full washdown evolution (Wenzel, 2000c).

4.4.6 U.S. Army Vessels

Onboard U.S. Army vessels, exterior topside surface washdowns are conducted after completion of transportation operations (i.e., embarking/disembarking ground equipment/cargo). The frequency of such practices are dependent on the operational scenario (i.e., ship is carrying war fighting ground equipment/cargo), but are always performed if the ship has taken green water (ocean water that washes over the decks in heavy seas) over the deck. It is common practice for a ship to conduct freshwater washdowns of the topside area prior to entering port. Almost all exterior topside surface washdowns occur inside 12 nm. Any petroleum product that falls from the war fighting ground equipment/cargo to the deck is immediately cleaned up. However, residual petroleum products may become trapped in the rough deck surface and have the potential to contribute to deck runoff. Whereas exterior topside surface washdowns almost always occur inside 12 nm, war fighting ground equipment/cargo is always taken off the ship to a land-based wash rack for washdown (Legge, 2002a).

4.4.7 WLM 175 Class

The crew reported that small amounts (less than 1 quart per month) of cleaning compound (Simple Green™) are used when performing cleaning. During the shipboard assessment, the entire crew focused on buoy maintenance and retrieval, hence no exterior topside surface washdowns were observed. Although only small amounts of cleaning compound (Simple Green™) are used, it is the primary constituent, that has the potential to contribute to deck runoff.

The buoy deck is rinsed after each buoy maintenance evolution to remove the residual marine growth. At the completion of each workday and prior to entering port, the buoy deck is

thoroughly washed down using seawater supplied by the vessel's firemain. In accordance with local policy, no detergents were used on the vessels surveyed. The deck is washed using a 3,000 psi pressure washer and fire hoses; the wash-down evolution takes approximately 45 min. Freshwater washdowns are performed infrequently, only in port, and use pier-supplied freshwater (no detergents) (Wenzel, 2000a). However, while the survey team did not report the use of cleaning compounds aboard the surveyed vessel, further research indicated this is not representative of the WLM 175 Class. As a general practice, a top to bottom washdown is conducted at intervals no greater than once per week, provided the ship has been underway. An estimated 5 gal of Simple Green™ is used per vessel per washdown. (Keel, 2001).

On these vessels, daily exterior topside surface washdowns do not contribute to deck runoff. The only materials that enter the surrounding water is marine growth, which is returned to the same "ecological area".

4.4.8 WAGB, WHEC, WMEC, WLI, WLIC, WLR, WTGB, WYTL, and WLB Classes

For the WAGB, WHEC, and WMEC Class vessels, complete topside washdowns are conducted following every patrol and are typically done in port. However, these washdowns may be commenced while at sea the day or night prior to mooring depending on weather conditions and availability of freshwater. During complete washdowns, approximately 5 gal of cleaning compound (Simple Green™) is used per vessel. These vessels make 2 to 6 patrols per year. Spot cleaning of deck surfaces is also conducted, as needed, while in port. It was estimated that during spot cleanings, 1 gal of cleaning compound (Simple Green™) is used per wash. Freshwater washdowns without soap are also conducted periodically throughout the time in port (Keel, 2001). For the WLI, WLIC, WLR, WTGB, and WYTL Class vessels, a freshwater washdown is conducted, at a minimum, upon their return to port. These vessels are in and out of port daily. Washdowns using cleaning compound (Simple Green™) are conducted approximately once per week using an estimated 1 gal of Simple Green™ (Keel, 2001). For the WLB Class vessels, washdowns are conducted approximately once per week provided the vessel has been underway. During washdowns, approximately 5 gal of cleaning compound (Simple Green™) is used per vessel (Keel, 2001). The primary constituent resulting from cleaning these vessels is the cleaning compound (Simple Green™).

4.4.9 WPB 110 , WPB 87, and Vessels 55 Ft and Under

The survey team conducted three pierside assessments of WPB 110 Class vessels at two homeports. During all assessments, dirt and debris were swept, containerized, and turned in to the homeport's Hazardous Materials Minimization Center. Because the overboard discharge of detergents at the first homeport surveyed is prohibited, the crew swabs their decks using a mop dampened with freshwater and a very small amount of cleaning compound (Simple Green™). The crew ensures excess water containing the detergent does not drain overboard in port. The primary constituent resulting from cleaning is a small amount of cleaning compound (Simple Green™). However, while the surveyed patrol boat reported very limited use of detergents, further research indicated this is not representative of the WPB and Under 55 ft Classes. For the WPB 110 and WPB 87 Classes, the general practice is a top to bottom wash with a solution of cleaning compound in freshwater upon return to port (approximately 3 to 4 times per month). During washdowns, approximately 2 gal of cleaning compound (Simple Green™) is used per vessel (Keel, 2001). These patrol boats are also frequently spot cleaned on the aft freeboard

because that area is heavily blackened by the exhaust soot. The general rule for vessels under 55 ft is a freshwater washdown, at a minimum upon returning to port; these vessels are in and out daily. Washdowns using cleaning compound solutions occur at intervals no greater than once daily. During washdowns, approximately 0.5 gal of cleaning compound (Simple Green™) is used per vessel. The washwater drains directly overboard. There are also reports that the fleet uses approximately 2 oz to 6 oz of Zip Wax™ Car Wash per washdown (Keel, 2001).

Due to the unique mission of WPB Class vessels, they are sometimes required to hold and transport migrants on the weather deck of the vessel. The migrants remain on the weather deck and do not enter the hull of the vessel. During these missions, other materials such as human waste, fibers from blankets and clothes, as well as human hair and food particles contribute to deck runoff. A portable toilet is placed on a shrouded area of the weather deck and remains topside until the migrants disembark. The portable toilet is not piped to the vessel's plumbing. The crew is required to drain the toilet overboard and hose down the area. During this process, or when migrants choose not to use the toilet facilities, human waste residue may remain trapped in the rough deck surface and contribute to deck runoff inside 12 nm.. These vessels frequently carry as many as 30 – 50 migrants for a period of several days. The time the migrants are aboard the vessel is dependent upon several factors (e.g., how far away the vessel is from a larger receiving vessel the vessel is, how long it takes to resolve legal issues, and how long it will take the vessel to transit if they are required to return the migrants to their homeland). The migrants are housed on the aft section of the weather deck and only moved forward during exterior topside surface washdowns. The crew reported that fibers from blankets and clothes, as well as human hair and food particles, litter the deck and are washed overboard; this most frequently (85 %) occurs outside 12 nm. The crew indicated that most deck runoff occurs during exterior topside surface washdowns conducted after alien migration interdiction operations (Wenzel *et al*., 2001a).

The vessels at each homeport conducted exterior topside surface washdown operations differently. The exterior topside surface washdown processes for the two homeports visited are described below (Wenzel *et al*., 2001a).

> *Homeport A:* When pierside, the crew uses freshwater supplied from pierside services to rinse the vessel twice weekly. This rinsing process takes 2 hr using a 0.75-inch garden hose at a pressure of 40 psi to 50 psi, normally without an on/off nozzle attached. No detergents are used when pierside. When underway, washdowns are conducted prior to entering port, approximately 17 times per month. The crew estimated 75 % of underway washdowns are conducted within the contiguous zone. The crew uses freshwater and approximately 0.5 gal of cleaning compound (0.5 gal of Simple Green™ and 2 oz to 3 oz of Brite Creme™) on the hull. The washdown process takes 8 hr (depending on how dirty the deck is) using freshwater and a garden hose equipped with an on/off nozzle. The crew estimated that the water is on for approximately 3 hr of the 8 hr.
>
> *Homeport B:* When pierside, weekly washdowns are conducted using freshwater and 0.5 gal of cleaning compound (Simple Green™). This process takes approximately 4 hr using a 0.75 in garden hose with a water pressure of 50 psi to 70 psi and an on/off nozzle attached. When underway, the crew uses only salt water supplied from the vessels 160 psi

firemain. Depending on how dirty the deck is, this process takes approximately 2 hr to 3 hr.

4.4.10 Cleaning Compounds

During the shipboard assessments, the survey team observed the crews performing cleaning throughout the day. On almost every vessel visited, the survey team noted very clean weather decks with no visible paint chips, dirt, or debris and attributed this to good housekeeping. As a result of the survey team's observations, cleaning should be considered a marine pollution control device (MPCD) to control paint debris from entering surrounding waters (Wenzel *et al*., 2001a). Constituents resulting from painting activities are addressed in more detail in the exterior topside surface preservation section.

Sweeping As part of the vessel crews' daily routine, it is common practice to sweep all decks at least twice daily and immediately following all paint removal evolutions. Immediately after sweeping, all debris is containerized and removed from the area. If visible debris remains on the deck, the area is vacuumed. All debris containing paint chips is turned in to the HAZMINCEN (hazardous materials minimization center) for disposal ashore.

Swabbing Also as part of the vessel's daily routine, it is common practice to damp-swab topside decks. This process uses small quantities of water that does not run overboard. In fact, swabbing the decks enhances the removal of residual paint debris.

Trash Removal. All debris containing paint chips is turned in to the shipboard HAZMINCEN for disposal ashore.

The following information was obtained during the AOE 6, DDG 51, MCM 1, WLM 175 and WPB 110 Class shipboard assessments**.** The exterior topside surface washdown process varies from vessel to vessel. Vessels that operate on the high seas generally wash decks while underway and outside the contiguous zone. Vessels operating within the contiguous zone often wash down decks while in port. Exterior topside surface washdown practices are listed in the following table.

Table 4-6— Exterior Topside Surface Washdown Practices

Vessel Class	Cleaning Compound	Cleaning Compound Amount	Washdown Conducted Inside/Outside Contiguous Zone	Water Used	Frequency
AOE 6	MIL-D-16791G	1.5 gal	Outside	Freshwater	Weekly
CV/CVN 68	B&B 88	550 gal	Outside	Saltwater	Prior to entering contiguous zone
DDG 51	MIL-D-16791G	1 gal	Outside	Freshwater	Weekly
LHD 1	B&B 88	Unknown	Outside	Saltwater	Prior to entering contiguous zone
MCM 1	Simple Green™	2 gal	Inside	Freshwater	3 week cycle
WAGB	Simple Green™	5 gal	Inside	Freshwater	2-6 times/yr
WLI	Simple Green™	1 gal	Inside	Freshwater	Weekly
WLB	Simple Green™	5 gal	Inside	Freshwater	Weekly
WLM 175	Simple Green™	5 gal	Inside	Fresh/Salt*	Weekly
WPB 110	Simple Green™ Brite Creme	2 gal 2 oz to 3 oz	Inside Inside	Freshwater Freshwater	Weekly Weekly
≤ 55 ft	Simple Green™ Zip Wax Car Wash™	0.5 gal 2 oz to 6 oz	Inside Inside	Freshwater Freshwater	Daily Daily

*WLM used salt water when underway and freshwater when in port.
*WAGB Class also includes: WHEC, WMEC
*WLI Class also includes: WLIC, WLR, WTGB, and WYTL
*WPB 110 Class also includes: WPB 87

Vessels that perform exterior topside surface washdowns outside the contiguous zone may have residual amounts of cleaning compounds trapped in the rough deck surfaces. While the amount of cleaning compounds is unknown, it could contribute to deck runoff within 12 nm. Cleaners used in port during exterior topside surface washdowns contribute to deck runoff. Human waste and debris may also be contributors to deck runoff onboard the WPB Class vessels (see section 4.4.9).

Example calculations for discharges inside 12 nm are as follows:

MCM 1. MCM 1 Class vessels are categorized as mine warfare vessels. There are 14 MCM 1 Class vessels. All assumptions are based on information gathered onboard the MCM Class vessels surveyed. Assuming 60 % of the year (i.e., 31 weeks) is spent operating within 12 nm or in port, the following applies:

31wks x 1 washdown every 3 weeks ≈ 10 washdowns x 2 gal of cleaning compound (Simple Green™) per washdown = 20 gal/vessel·yr.

20 gal/vessel·yr x 14 vessels= 280 gal of cleaning compound (Simple Green™).

WLM 175 (USCG). WLM 175 Class vessels are categorized as tenders; there are 83 vessels in this class. All assumptions are based on information gathered onboard the WLM 175 Class

vessels surveyed. WLM Class vessels use a cleaning compound (Simple Green™) for exterior topside surface washdown.

WPB 110 (USCG). WPB 110 Class patrol vessels are categorized as cutters. There are 96 smaller cutters that operate as patrol craft vessels. These patrol cutters do not necessarily provide an accurate representation of the vessels in the small boats and craft category. All assumptions are based on information gathered onboard the WPB Class vessels surveyed. Assuming 90 % of the year (i.e., 47 weeks) is spent operating within 12 nm or in port, the following applies:

47 wks x 2 gal cleaning compound (Simple Green™)= 94 gal/vessel·yr.
94 gal/vessel·yr x 96 vessels= 9024 gal of cleaning compound (Simple Green™)

47 wks x 0.02 gallon cleaning compound (Brite Creme™)= 0.94 gallon/vessel·yr.
0.94 gallon/vessel·yr x 96 vessels= 90 gal of cleaning compound (Brite Creme™)

Table 4-7— Potential Discharge Materials for Exterior Topside Surface Washdowns

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Cleaning Compound (Simple Green™)	2.0E+05 (estimated)	2-Butoxyethanol	111762	< 6	< 1.2E+04	None
Cleaning Compound (Brite Creme™)	9.0E+01 (estimated)	Unknown	—	Unknown	Unknown	Unknown
Cleaning Compound (Zip Wax Car Wash™)	1.5E+04 (estimated)	Unknown	—	Unknown	Unknown	Unknown
Flight Deck Cleaner (B&B 88)	Negligible	Unknown	—	Unknown	Negligible	Unknown
Degreaser, MIL-D-16791G	Negligible	Unknown	—	Unknown	Negligible	Unknown
Hydraulic Fluid, MIL-PRF-83282D	Negligible	Synthetic hydrocarbon based oil Ester based lubricant	— —	> 65 < 35	Negligible Negligible	Unknown Unknown
Grease, MIL-PRF-81322F	Negligible	Mixture of paraffinic, naphthenic and aromatic hydrocarbons	—	Unknown	Negligible	Unknown
Gas Path Cleaner, MIL-C-85704C	Negligible	Dipropylene glycol methyl ether	34590948	10	Unknown	Unknown
		Hexylene glycol	107415	10	Unknown	Unknown
		Heavy aromatic naphtha	64742945	Unknown	Unknown	Unknown
		Triethanolamine	102716	Unknown	Unknown	Unknown
		Nonylphenol polyethoxate	9016459	Unknown	Unknown	Unknown
Human Waste/Debris	Unknown	Unknown	—	Unknown	Unknown	Unknown
Jet Exhaust Soot	Unknown	Unknown	—	Unknown	Unknown	Unknown

*Note: A full analysis was not conducted on jet exhaust soot, but may contain carbonaceous material, sulfates, and by-products of incomplete combustion of JP-5.

Table 4-8—Narrative Parameters for Exterior Topside Surface Washdowns

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential Exists
Hardness	Potential Exists
Nutrients	Unknown-not evaluated
Odor	Potential Exists-did not evaluate
Oil and Grease	None observed, no sheen noted
Pathogens	Potential Exists-not qualified to evaluate
PH	Unknown-not evaluated
Settleable Materials	Potential Exists
Specific Conductance	Unknown-not evaluated
Suspended Solids	Potential Exists
Taste	Unknown-not evaluated
Temperature	Does not change temperature
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of the assessment. The information is based on survey team recollection and consensus.

4.5 FIREMAIN SYSTEMS

Contaminants that may or may not result from using firemain systems are being addressed as a separate UNDS discharge. The survey team was tasked to determine if the firemain system contributes to deck runoff. The firemain system on all vessels surveyed used saltwater supplied at various pressures, depending on vessel class. Saltwater from this system is also used during the exterior topside surface washdown evolution on some vessels. Therefore, water from the firemain is a component of deck runoff. However, the constituents from the firemain itself will be evaluated as its own discharge.

4.6 PERFORMANCE OBJECTIVE AND ACTIVITIES

The objective for cleaning activities/general housekeeping is for the vessel's responsible party to prevent the discharge of cleaning compounds, hydraulic fluids, oils, fuels, greases, dirt, salts, soot, and other materials associated with cleaning activities/general housekeeping that may negatively impact water quality. Activities that could be performed to meet this performance objective include, but are not limited to: minimizing cleaning for aircraft, exterior topside surfaces (ETS), equipment, and vehicles within 12 nm; using a vacuum to remove water from aircraft washdowns conducted outside 12 nm; using a flight deck scrubber; and cleaning deck tie down fixtures with vacuums.

Fixed and rotary wing aircraft are washed both inside and outside 12 nm, depending on the patrol areas of the vessels to which they are assigned. When the patrol for aircraft capable vessels occurs beyond 12 nm, the aircraft are generally washed outside 12 nm. For example, fixed wing aircraft, found only on Navy vessels, are always washed outside 12 nm. Rotary wing aircraft can

be washed inside or outside 12 nm. On Navy vessels, rotary wing aircraft operations occur outside 12 nm. These aircraft are washed outside 12 nm. On USCG vessels, rotary wing aircraft may be washed inside or outside 12 nm, with the majority of aircraft washes occurring outside 12 nm. If the aircraft were washed outside 12 nm, the washwater, grease, detergents, and other constituents flowing overboard would not be regulated by UNDS and only the residue that becomes trapped in the rough deck surface has the potential to contribute to deck runoff inside 12 nm.

Exterior topside surface (ETS) washdowns are conducted both inside and outside 12 nm, depending on the patrol area of the vessel. If ETSs were washed outside 12 nm, the mass loadings of constituents present on the deck that contribute to deck runoff inside 12 nm would be reduced. Vessels perform ETS washdowns regardless of their location when conditions or requirements necessitate a washdown. For this activity, vessels would not specifically transit outside 12 nm to conduct ETS washdowns (Navy, 2001).

Conducting equipment and vehicle washdowns outside 12 nm would reduce constituents, such as grease and oil, from the deck that could contribute to deck runoff within 12 nm. Crews perform equipment and vehicle washdowns, regardless of their vessel's location, when washdowns are necessary based on conditions or requirements. For this activity, vessels would not specifically transit outside 12 nm to conduct equipment and vehicle washdowns. One method the U.S. Army uses to minimize washdowns inside 12 nm, is conducting equipment and vehicle washdowns on a land-based wash rack. The equipment is removed from the vessels and washed on a rack, where all the constituents are collected for proper disposal. Minimizing cleaning for equipment and vehicles is currently in place for the ground support equipment and vehicle transport processes (Navy, 2001).

During aircraft washdowns outside 12 nm, a wet/dry vacuum may be used to remove the washwater generated. A crewmember would use the vacuum to contain and recover the cleaning compound/water mixture before it becomes trapped in the rough deck surface where it could later contribute to deck runoff. No tanks are currently available to hold this washwater. Therefore, the washwater would be discharged overboard outside 12 nm. This activity does not present an environmental benefit for washdowns conducted inside 12 nm, because the washwater is discharged overboard. For vessels operating outside 12 nm, the constituents of deck runoff (e.g., dirt, oil, and grease) are removed from the deck before the vessel transits within 12 nm. Small aircraft-capable vessels (e.g., WMEC) that only carry one or two rotary wing aircraft have small flight decks. On these vessels, the aircraft washwater that is not trapped in the rough deck surface immediately runs to, or can be washed down, a deck drain that discharges directly overboard.

A flight deck scrubber is a ground washer that uses cleaning compounds, water, and rigid brush bristles to clean the flight deck. On the CV/CVN and LHD 1 Class vessels, a Tennant 550 Riding Power Scrubber is used to remove oil, grease, dirt, and other debris found on the flight deck. No tanks are currently available to hold this washwater. As a result, the washwater is discharged overboard, outside 12 nm. For smaller, air-capable vessels, such as the DDG 51 and AOE 6 Class vessels, smaller, walk-behind scrubbers are available. Operators walk behind these scrubbers; the scrubbers temporarily collect the water and debris in a holding tank. Using flight deck scrubbers

reduces the amount of constituents that may become trapped in the rough deck surface and subsequently contribute to deck runoff when the vessel transits within 12 nm. For vessels operating outside 12 nm, many of the constituents of deck runoff are removed or their contribution reduced, from the deck before the vessel transits within 12 nm. The rider scrubbers are currently used on all large flight deck vessels such as CV/CVN and LHD 1 Class vessels. Some smaller, air-capable vessels use walk-behind scrubbers. Small aircraft capable vessels only carry one or two small rotary wing aircraft. Washwater produced by manual scrubbing methods immediately runs to, or can be washed down, deck drains that discharge directly overboard. Therefore, flight deck scrubbers may not be practical for small aircraft capable vessels. The residuals of constituents trapped in the rough deck surface could subsequently contribute to deck runoff inside 12 nm.

The last activity is using a pneumatic wet/dry vacuum cleaner, or other effective means, to remove liquids and other debris out of recessed tie down fixtures. A recessed tie down fixture is used as a fastening point for straps and chains to secure aircraft and other equipment on a vessel's deck. The debris and constituents collected in the vacuums are containerized and discharged overboard outside 12 nm on Navy vessels. Cleaning the liquid and debris from the recessed tie down fixtures reduces the potential for these constituents to wash off the deck when the vessel is within 12 nm. USCG vessels operate both inside and outside 12 nm, therefore, cleaning the recessed tie down fixtures could occur inside or outside 12 nm. Performing this activity inside 12 nm is expected to produce a localized environmental benefit because the liquid and debris do not contribute to deck runoff while the vessel is in port.